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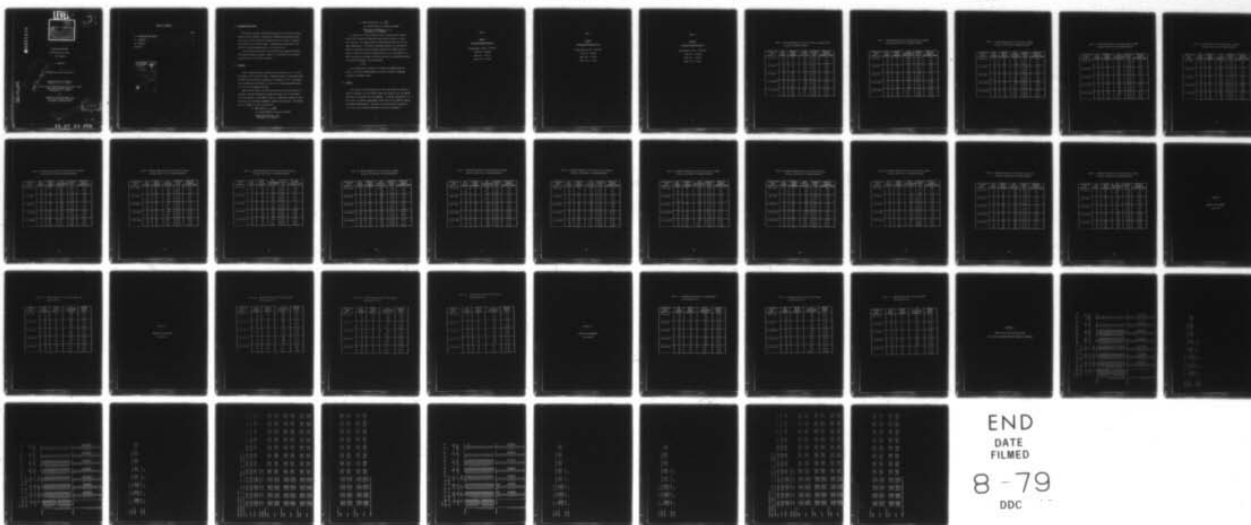
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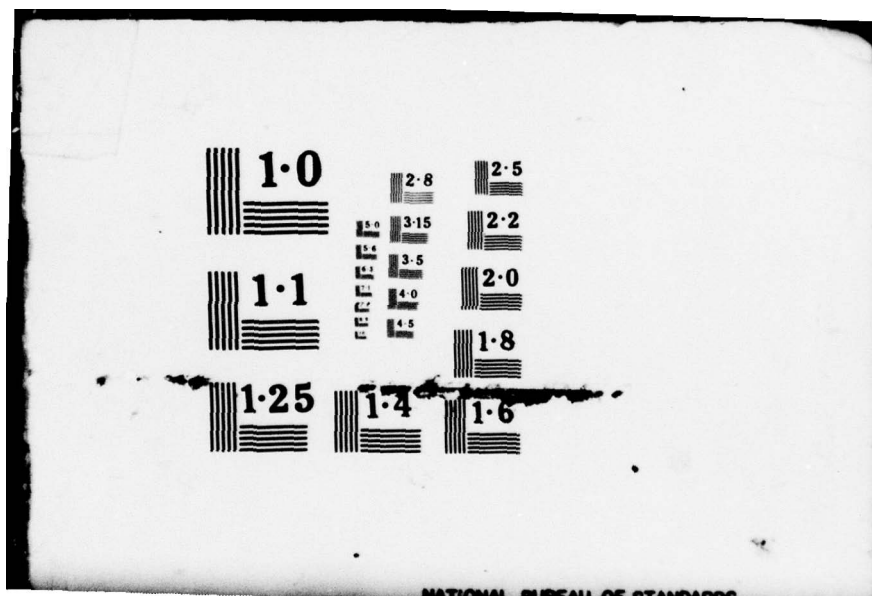
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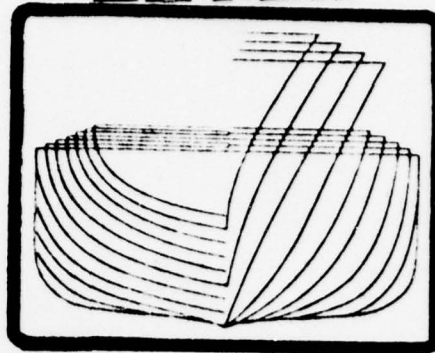
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MOTION PREDICTIONS  
FOR THE CVA-59, CVA-66  
AND CVAN-68

11 7 JUNE 1977

NAVSEC Report No. 6136-77-20

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## 1.0 BACKGROUND AND SCOPE

✓ This report presents motion predictions for the aircraft carriers CVA-59, CVA-66, CVAN-68. Specifically, NAVSEA 942W requested pitch, roll and yaw rates and period information for Sea States 2 through 6 and speeds of 10, 20 and 25 knots. Furthermore headings were to be selected to yield maximum pitch, roll and yaw rates.

The predictions were made using the MITA five-degree-of-freedom ship motions computer program. Tables 1, 2 and 3 give the principal characteristics of the three carriers. ↗

## 2.0 APPROACH

Motion predictions were conducted for Sea States 2, 3, 4, 5 and 6 and speeds of 10, 20 and 25 knots. Headings between  $0^{\circ}$  (following seas) and  $180^{\circ}$  (head seas) were considered in increments of  $15^{\circ}$ . The output of the program was then used to arrive at the required maximum values of rate and corresponding periods.

RMS values of pitch, roll and yaw velocities and accelerations in irregular seas were computed by taking the square root of the second and fourth moments of each mode of motion. Significant values for each rate were then calculated assuming a Rayleigh distribution. The following is a summary of these calculations:

$$1) \text{ RMS velocity} = \sigma_v = \sqrt{m_2}$$

$m_2$  = second moment of response spectrum

$$\text{Significant velocity} = 4 \sigma_v \\ \text{(Average of 1/3 highest)}^v$$

$$2) \text{ RMS acceleration} = \sigma_a = \sqrt{m_4}$$

$m_4$  = fourth moment of response spectrum

Significant acceleration =  $4 \sigma_a$   
(Average of 1/3 highest)

In addition to these velocities and accelerations the average period and the period of maximum response were obtained for pitch roll and yaw. The average period is obtained directly from the program computations. The period of maximum response for each mode of motion is obtained from the response spectrum by looking up the frequency at which the specific response (pitch, roll, yaw) peaks out. These frequencies are given in rad/sec and must be converted to period in seconds according to the relationship

$$T = \frac{2\pi}{\omega}$$

For completeness, although not requested by NAVSEA 942W, the pitch, roll and yaw displacements were also recorded for headings yielding the maximum values.

### 3.0 RESULTS

The results of the predictions of rates and periods are given in Tables 4 through 9 for the CVA-59; Tables 10 through 15 for the CVA-66; and Tables 16 through 21 for the CVAN-68. In addition Appendices A, B and C give the angular displacement predictions for the CVA-59, CVA-66 and CVAN-68 respectively. The input to the MITA motions program for each of the three carriers considered is given in Appendix D.

Table 1

CVA-59

Principal Characteristics

Displacement (tons) - 76740.00

LBP (ft) - 990.00

Beam (ft) - 129.33

Draft (ft) - 36.00

Table 2

CVA-66

Principal Characteristics

Displacement (tons) - 81711.00

LBP (ft) - 990.00

Beam (ft) - 129.33

Draft (ft) - 37.08

Table 3

CVAN-68

Principal Characteristics

Displacement (tons) - 91440.00

LBP (ft) - 1040.00

Beam (ft) - 134.00

Draft (ft) - 36.83



Table 4 CVA-59 Significant Pitch Velocities, Average Periods,  
Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.067	7.63	5.27
	20	0	.153	2.70	4.40
	25	45	.075	3.21	4.29
4.90 (SS3)	10	60	.147	8.44	6.35
	20	0	.142	4.06	5.09
	25	90	.110	6.15	6.97
6.50 (SS4)	10	60	.234	9.45	8.80
	20	90	.168	6.76	7.16
	25	90	.156	6.57	7.04
10.20 (SS5)	10	135	.541	8.77	11.00
	20	135	.498	7.90	11.75
	25	135	.453	7.55	11.75
16.90 (SS6)	10	135	1.60	9.89	11.81
	20	135	1.77	8.86	12.50
	25	135	1.77	8.50	12.44

Table 5 CVA-59 Significant Pitch Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.080	5.06	5.45
	20	0	.846	2.70	4.40
	25	45	.360	3.21	4.29
4.90 (SS3)	10	90	.142	6.45	6.97
	20	0	.565	4.06	5.09
	25	30	.256	7.58	5.77
6.50 (SS4)	10	90	.198	6.98	7.35
	20	90	.168	6.76	7.16
	25	30	.184	10.78	6.12
10.20 (SS5)	10	135	.407	8.77	11.00
	20	135	.414	7.90	11.75
	25	135	.395	7.55	11.75
16.90 (SS6)	10	135	1.06	9.89	11.81
	20	135	1.30	8.86	12.50
	25	135	1.35	8.50	12.50



Table 6 CVA-59 Significant Roll Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.045	8.17	6.85
	20	60	.184	11.16	4.40
	25	60	.220	18.81	5.45
4.90 (SS3)	10	60	.155	9.20	6.97
	20	45	.797	21.60	6.97
	25	60	.573	18.70	6.97
6.50 (SS4)	10	60	.236	9.49	7.16
	20	45	1.45	20.66	7.35
	25	60	.867	18.13	7.03
10.20 (SS5)	10	60	.503	10.93	11.00
	20	45	2.57	19.97	7.85
	25	60	1.53	17.69	7.35
16.90 (SS6)	10	60	1.26	14.11	13.51
	20	45	5.32	20.36	13.51
	25	60	4.13	19.14	15.14

Table 7 CVA-59 Significant Roll Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.043	4.68	5.10
	20	30	.340	6.08	5.10
	25	45	.373	14.25	5.45
4.90 (SS3)	10	60	.155	9.20	6.97
	20	45	.308	21.60	6.97
	25	60	.279	18.70	6.97
6.50 (SS4)	10	60	.176	9.49	7.16
	20	45	.465	20.66	7.35
	25	60	.327	18.13	7.03
10.20 (SS5)	10	60	.304	10.93	11.00
	20	45	.820	19.97	7.85
	25	60	.550	17.69	7.35
16.90 (SS6)	10	60	.600	14.11	13.51
	20	45	1.65	20.36	13.51
	25	60	1.37	19.14	15.14

Table 8 CVA-59 Significant Yaw Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.056	4.32	5.46
	20	45	.478	4.64	4.17
	25	90	.056	4.31	5.27
4.90 (SS3)	10	90	.092	5.41	6.23
	20	45	.412	6.70	4.70
	25	90	.090	5.35	6.11
6.50 (SS4)	10	90	.116	6.02	7.04
	20	45	.336	9.13	5.03
	25	60	.128	17.27	9.36
10.20 (SS5)	10	60	.296	11.85	10.00
	20	60	.338	14.78	9.68
	25	60	.355	17.11	9.68
16.90 (SS6)	10	60	.681	13.07	11.37
	20	60	.729	15.64	11.12
	25	60	.731	17.55	10.93

Table 9 CVA-59 Significant Yaw Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.098	4.32	5.46
	20	45	1.71	4.64	4.17
	25	45	.139	32.83	5.27
4.90 (SS3)	10	90	.126	5.41	6.22
	20	45	1.01	6.70	4.70
	25	90	.126	5.35	6.11
6.50 (SS4)	10	90	.141	6.02	7.04
	20	45	.572	9.13	5.03
	25	90	.140	5.96	6.91
10.20 (SS5)	10	90	.162	6.96	8.11
	20	45	.178	17.22	10.49
	25	135	.160	6.67	11.00
16.90 (SS6)	10	60	.337	13.07	11.37
	20	135	.358	8.47	12.50
	25	135	.372	7.95	12.50



Table 10 CVA-66 Significant Pitch Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.067	7.64	5.27
	20	0	.157	2.72	4.40
	25	45	.081	3.20	4.29
4.90 (SS3)	10	60	.147	8.44	6.97
	20	0	.146	4.08	5.09
	25	90	.103	6.23	6.97
6.50 (SS4)	10	60	.234	9.44	8.80
	20	90	.160	6.86	7.16
	25	90	.147	6.67	7.16
10.20 (SS5)	10	135	.531	8.82	11.00
	20	135	.478	7.95	11.75
	25	135	.432	7.60	12.51
16.90 (SS6)	10	135	1.60	9.92	11.81
	20	135	1.73	8.91	12.50
	25	135	1.73	8.55	12.50

Table 11 CVA-66 Significant Pitch Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.073	5.07	5.10
	20	0	.869	2.72	4.40
	25	45	.386	3.20	4.29
4.90 (SS3)	10	90	.133	6.53	6.97
	20	0	.581	4.08	5.09
	25	45	.248	5.81	7.29
6.50 (SS4)	10	90	.188	7.07	7.35
	20	0	.380	5.75	9.36
	25	45	.156	10.59	7.73
10.20 (SS5)	10	135	.396	8.82	11.00
	20	135	.394	7.95	11.75
	25	135	.374	7.60	12.57
16.90 (SS6)	10	135	1.05	9.92	11.81
	20	135	1.27	8.91	12.50
	25	135	1.32	8.55	12.50

Table 12 CVA-66 Significant Roll Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.042	8.16	6.85
	20	60	.182	10.94	4.28
	25	60	.179	17.02	5.71
4.90 (SS3)	10	60	.163	9.23	6.97
	20	45	.661	23.06	6.97
	25	60	.473	18.13	6.97
6.50 (SS4)	10	60	.263	9.51	7.35
	20	45	1.15	21.42	7.35
	25	60	.738	17.70	7.03
10.20 (SS5)	10	60	.484	10.67	11.00
	20	30	2.04	23.96	8.68
	25	45	1.69	25.83	8.67
16.90 (SS6)	10	60	1.08	13.67	12.88
	20	30	4.47	23.59	9.86
	25	45	4.58	24.11	12.06



Table 13 CVA-66 Significant Roll Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	135	.034	4.17	5.45
	20	60	.333	10.94	4.28
	25	45	.381	15.60	5.45
4.90 (SS3)	10	60	.106	9.53	6.97
	20	45	.296	23.06	6.97
	25	45	.275	30.71	8.17
6.50 (SS4)	10	60	.176	9.51	7.35
	20	45	.372	21.42	7.35
	25	60	.288	17.70	7.03
10.20 (SS5)	10	60	.297	10.67	11.00
	20	30	.566	23.96	8.68
	25	60	.468	17.44	7.35
16.90 (SS6)	10	60	.534	13.67	12.88
	20	45	1.23	20.58	15.14
	25	45	1.20	24.11	12.06

Table 14 CVA-66 Significant Yaw Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.054	4.33	5.24
	20	45	.496	4.64	5.95
	25	90	.054	4.20	5.24
4.90 (SS3)	10	90	.088	5.41	6.21
	20	45	.428	6.68	4.89
	25	90	.087	5.35	6.11
6.50 (SS4)	10	90	.112	6.02	6.91
	20	45	.348	9.05	5.03
	25	60	.126	17.21	8.80
10.20 (SS5)	10	60	.292	11.87	10.00
	20	60	.335	14.80	10.00
	25	60	.353	17.13	9.68
16.90 (SS6)	10	60	.679	13.10	11.56
	20	60	.731	15.68	11.12
	25	60	.740	17.59	10.93

Table 15 CVA-66 Significant Yaw Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.094	4.33	5.24
	20	45	1.78	4.64	5.95
	25	45	.140	32.80	5.24
4.90 (SS3)	10	90	.121	5.41	6.23
	20	45	1.05	6.68	4.89
	25	90	.122	5.35	6.11
6.50 (SS4)	10	90	.135	6.02	6.91
	20	45	.593	9.05	5.03
	25	90	.134	5.95	6.91
10.20 (SS5)	10	60	.136	11.87	10.00
	20	45	.183	17.12	10.56
	25	135	.157	6.69	11.00
16.90 (SS6)	10	60	.335	13.10	11.56
	20	135	.355	8.50	12.44
	25	135	.368	7.98	12.50

Table 16 CVAN-68 Significant Pitch Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.059	7.63	5.27
	20	0	.147	2.97	4.61
	25	45	.111	3.37	4.52
4.90 (SS3)	10	60	.130	8.43	6.35
	20	0	.139	4.68	5.60
	25	30	.097	7.14	5.87
6.50 (SS4)	10	60	.199	9.39	8.80
	20	90	.154	7.01	7.35
	25	90	.142	6.85	7.35
10.20 (SS5)	10	60	.454	11.33	10.00
	20	135	.377	8.05	11.75
	25	135	.346	7.64	11.75
16.90 (SS6)	10	135	1.33	10.13	12.50
	20	135	1.45	9.09	12.50
	25	135	1.44	8.69	12.88



Table 17 CVAN-68 Significant Pitch Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.068	5.09	5.45
	20	0	.794	2.97	4.61
	25	45	.523	3.37	4.52
4.90 (SS3)	10	90	.122	6.57	7.29
	20	*0	.538	4.68	5.60
	25	45	.340	5.51	7.29
6.50 (SS4)	10	90	.178	7.15	7.48
	20	0	.356	6.36	6.12
	25	30	.270	10.13	6.28
10.20 (SS5)	10	90	.266	7.73	8.11
	20	135	.306	8.05	11.75
	25	135	.299	7.64	11.75
16.90 (SS6)	10	135	.861	10.13	12.50
	20	135	1.04	9.09	12.50
	25	135	1.08	8.69	12.88

Table 18 CVAN-68 Significant Roll Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.052	7.70	6.84
	20	30	.255	3.57	4.40
	25	45	.175	5.68	5.45
4.90 (SS3)	10	60	.145	9.09	7.29
	20	45	.381	21.31	7.29
	25	60	.304	17.16	7.29
6.50 (SS4)	10	60	.252	9.48	7.35
	20	45	.776	20.11	8.36
	25	60	.546	17.01	7.35
10.20 (SS5)	10	60	.480	10.76	7.67
	20	45	1.59	19.51	8.48
	25	60	1.15	17.22	7.67
16.90 (SS6)	10	60	1.18	14.17	13.51
	20	45	3.64	20.20	13.51
	25	60	3.34	18.95	14.20

Table 19 CVAN-68 Significant Roll Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	60	.044	7.70	6.84
	20	30	1.17	3.57	4.40
	25	45	.733	5.68	5.45
4.90 (SS3)	10	60	.103	9.09	7.29
	20	30	.756	10.71	8.80
	25	45	.520	20.59	8.80
6.50 (SS4)	10	60	.170	9.48	7.35
	20	30	.481	21.39	8.80
	25	45	.366	26.29	8.36
10.20 (SS5)	10	60	.294	10.76	7.67
	20	45	.516	19.51	8.48
	25	60	.423	17.22	7.67
16.90 (SS6)	10	60	.564	14.17	13.51
	20	45	1.14	20.20	13.51
	25	60	1.12	18.95	14.20



Table 20 CVAN-68 Significant Yaw Velocities, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW VELOCITY (DEG/SEC)	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	45	.050	10.53	4.52
	20	45	.846	4.58	4.17
	25	60	.106	6.52	4.29
4.90 (SS3)	10	90	.084	5.62	6.35
	20	45	.727	6.39	4.70
	25	60	.094	10.38	8.73
6.50 (SS4)	10	90	.110	6.31	7.35
	20	45	.584	8.46	4.86
	25	60	.106	15.15	9.36
10.20 (SS5)	10	60	.233	12.02	10.49
	20	45	.362	15.40	11.00
	25	60	.281	17.25	9.99
16.90 (SS6)	10	60	.594	13.41	11.81
	20	60	.640	15.94	11.37
	25	60	.642	17.77	11.12

Table 21 CVAN-68 Significant Yaw Accelerations, Average  
Periods, and Periods of Maximum Response

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW ACCELERATION (DEG/SEC <sup>2</sup> )	AVERAGE PERIOD (SEC)	PERIOD OF MAXIMUM RESPONSE (SEC)
3.02 (SS2)	10	90	.088	4.38	5.45
	20	45	3.03	4.58	4.17
	25	60	.314	6.52	4.29
4.90 (SS3)	10	90	.110	5.62	6.35
	20	45	1.78	6.39	4.69
	25	45	.217	25.00	5.99
6.50 (SS4)	10	90	.126	6.31	7.35
	20	45	1.01	8.46	4.86
	25	45	.149	31.53	6.47
10.20 (SS5)	10	135	.159	8.05	11.00
	20	45	.296	15.40	11.00
	25	135	.155	6.78	11.00
16.90 (SS6)	10	135	.333	9.73	12.06
	20	135	.370	8.57	12.50
	25	135	.377	8.11	12.50

APPENDIX A

ANGULAR DISPLACEMENTS

FOR CVA-59

Table A.1 CVA-59 Significant Pitch Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	60	.082	7.63
	20	0	.066	2.70
	25	60	.048	14.76
4.90 (SS3)	10	60	.198	8.44
	20	60	.150	13.81
	25	60	.123	17.95
6.50 (SS4)	10	60	.352	9.45
	20	60	.280	13.98
	25	60	.249	17.29
10.20 (SS5)	10	60	.942	11.21
	20	60	.804	14.76
	25	60	.749	17.20
16.90 (SS6)	10	135	2.52	9.89
	20	135	2.49	8.86
	25	135	2.39	8.50

Table A.2 CVA-59 Significant Roll Displacement and  
Average Periods

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	60	.059	8.17
	20	45	.696	24.77
	25	60	.658	18.81
4.90 (SS3)	10	60	.226	9.20
	20	45	2.74	21.60
	25	60	1.71	18.70
6.50 (SS4)	10	60	.397	9.49
	20	45	4.75	20.66
	25	60	2.50	18.13
10.20 (SS5)	10	45	.896	12.00
	20	45	8.16	19.97
	25	45	5.07	26.38
16.90 (SS6)	10	60	2.82	14.11
	20	45	17.24	20.36
	25	60	12.58	19.14



Table A.3 CVA-59 Significant Yaw Displacement and  
Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	90	.038	4.32
	20	45	.353	4.64
	25	45	.265	32.83
4.90 (SS3)	10	90	.079	5.41
	20	45	.440	6.70
	25	45	.612	47.96
6.50 (SS4)	10	60	.157	10.33
	20	45	.488	9.13
	25	45	.834	46.94
10.20 (SS5)	10	60	.549	11.85
	20	60	.794	14.78
	25	45	1.33	33.10
16.90 (SS6)	10	60	1.42	13.07
	20	60	1.82	15.64
	25	45	2.64	25.71

Appendix B

ANGULAR DISPLACEMENTS

FOR CVA-66



Table B.1 CVA-66 Significant Pitch Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	60	.082	7.64
	20	0	.068	2.72
	25	60	.053	13.67
4.90 (SS3)	10	60	.198	8.44
	20	60	.154	13.81
	25	60	.129	17.76
6.50 (SS4)	10	60	.351	9.44
	20	60	.282	13.99
	25	60	.250	17.32
10.20 (SS5)	10	60	.940	11.21
	20	60	.800	14.77
	25	60	.744	17.22
16.90 (SS6)	10	135	2.52	9.92
	20	135	2.47	8.91
	25	135	2.36	8.55

Table B.2 CVA-66 Significant Roll Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	60	.055	8.16
	20	45	.778	27.47
	25	60	.489	17.02
4.90 (SS3)	10	60	.225	9.23
	20	45	2.42	23.06
	25	60	1.37	18.13
6.50 (SS4)	10	60	.398	9.51
	20	45	3.93	21.42
	25	45	2.60	28.69
10.20 (SS5)	10	45	.882	11.96
	20	30	8.16	23.96
	25	45	6.93	25.83
16.90 (SS6)	10	60	2.34	13.67
	20	30	16.82	23.59
	25	45	17.56	24.11

Table B.3 CVA-66 Significant Yaw Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	90	.037	4.33
	20	45	.366	4.64
	25	45	.269	32.80
4.90 (SS3)	10	90	.076	5.41
	20	45	.455	6.68
	25	45	.621	48.08
6.50 (SS4)	10	60	.154	10.34
	20	45	.501	9.05
	25	45	.842	47.37
10.20 (SS5)	10	60	.552	11.87
	20	60	.789	14.80
	25	45	1.34	33.33
16.90 (SS6)	10	60	1.41	13.10
	20	60	1.83	15.68
	25	45	2.68	25.67

APPENDIX C

ANGULAR DISPLACEMENTS

FOR CVAN-68

Table C.1 CVAN-68 Significant Pitch Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	PITCH DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	60	.072	7.63
	20	60	.070	13.52
	25	60	.065	11.21
4.90 (SS3)	10	60	.174	8.43
	20	60	.149	13.86
	25	60	.137	16.72
6.50 (SS4)	10	60	.297	9.39
	20	60	.247	14.05
	25	60	.229	17.44
10.20 (SS5)	10	60	.819	11.33
	20	60	.703	14.86
	25	60	.666	17.33
16.90 (SS6)	10	135	2.15	10.13
	20	135	2.10	9.09
	25	135	1.99	8.69



Table C.2 CVAN-68 Significant Roll Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	ROLL DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	45	.078	10.64
	20	60	.334	10.31
	25	60	.217	14.75
4.90 (SS3)	10	60	.211	9.09
	20	45	1.29	21.31
	25	60	.831	17.16
6.50 (SS4)	10	60	.380	9.48
	20	45	2.48	20.11
	25	45	1.70	26.29
10.20 (SS5)	10	60	.822	10.76
	20	45	4.93	19.51
	25	45	4.33	25.74
16.90 (SS6)	10	60	2.66	14.17
	20	45	11.70	20.20
	25	45	10.71	24.28

Table C.3 CVAN-68 Significant Yaw Displacement  
and Average Period

SIGNIFICANT WAVE HEIGHT, FT.	SHIP SPEED (KNOTS)	HEADING ANGLE (DEGREES)	YAW DISPLACEMENT (DEGREES)	AVERAGE PERIOD (SEC)
3.02 (SS2)	10	45	.083	10.53
	20	45	.617	4.58
	25	45	.134	11.11
4.90 (SS3)	10	45	.120	10.21
	20	45	.740	6.39
	25	45	.325	25.00
6.50 (SS4)	10	45	.146	10.23
	20	45	.786	8.64
	25	45	.446	31.53
10.20 (SS5)	10	60	.446	12.02
	20	45	.888	15.40
	25	45	.834	28.42
16.90 (SS6)	10	60	1.27	13.41
	20	60	1.62	15.94
	25	45	2.10	24.49

APPENDIX D

INPUT TO MITA SHIP MOTIONS PROGRAM  
FOR EACH OF THE THREE AIRCRAFT CARRIERS CONSIDERED

INSTA	NRGMS	NENC	NVL	NMOT	NCP	NP	MD	NTUEB	HASBK	NB	NBEND	NMT	NPCH	NFO	NFR
21	27	7	5	0	0	15	0	0	1	0	0	0	0	1	0

NSFA	NWX	NSIMS	NS	NSPC	ID NAME	NEVT
2	5	0	0	1	0	0

CR	XLAP	REAM	DPAFT	GRAV	XCG	VCG	GM
0.5824	900.0000	129.3300	36.0000	32.1700	-19.2000	10.2000	10.1000

UNIT	ORIGIN	ZETAA	ALFA
0	-14.2000	10.0000	0.0303

STATION	I	XI(I)	YH(I)	ZH(I)	STGMA(I)	ZCB(I)	GIRTH(I)	RIFLR(I)	ALPH(I)
1	495.0000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	445.5000	15.5000	15.5000	36.0000	1.0827	-17.1000	62.6660	0.0	0.0
3	396.0000	32.3240	32.3240	36.0000	0.8577	-16.5000	91.0000	0.0	0.0
4	346.5000	50.6600	50.6600	36.0000	0.8274	-16.9000	101.3340	0.0	0.0
5	297.0000	69.6660	69.6660	36.0000	0.8043	-16.3000	115.1660	0.0	0.0
6	247.5000	87.8340	87.8340	36.0000	0.8161	-16.6000	130.6660	0.0	0.0
7	198.0000	102.8340	102.8340	36.0000	0.8409	-16.8000	146.8340	0.0	0.0
8	148.5000	114.8340	114.8340	36.0000	0.8702	-17.1000	160.3240	0.0	0.0
9	99.0000	122.1660	122.1660	36.0000	0.9174	-17.2000	170.6660	0.0	0.0
10	49.5000	126.1660	126.1660	36.0000	0.9503	-17.7000	181.0000	0.0	0.0
11	0.0	128.1660	128.1660	36.0000	0.9754	-17.8000	188.5000	0.0	0.0
12	-49.5000	129.2240	129.2240	36.0000	0.9870	-17.8000	191.6660	0.0	0.0
13	-99.0000	128.5000	128.5000	36.0000	0.9740	-17.4000	188.6660	0.0	0.0
14	-148.5000	127.5000	127.5000	36.0000	0.9576	-17.4000	182.2340	0.0	0.0
15	-198.0000	126.0000	126.0000	36.0000	0.9298	-17.0000	169.8340	0.0	0.0
16	-247.5000	123.0000	123.0000	36.0000	0.7964	-15.8000	157.0000	0.0	0.0
17	-297.0000	118.6660	118.6660	36.0000	0.6412	-13.4000	144.1660	0.0	0.0
18	-346.5000	111.8340	111.8340	36.0000	0.4794	-10.5000	140.8340	0.0	0.0
19	-396.0000	101.0000	101.0000	20.8230	0.5378	-6.1000	109.0000	0.0	0.0
20	-445.5000	85.5000	85.5000	14.0000	0.5218	-3.0000	89.3240	0.0	0.0
21	-495.0000	27.8340	27.8340	7.5000	0.5886	-0.2000	33.0340	0.0	0.0

STATION	TIME(H)	RWD(I)	BILRAD(I)	RUGLO(I)	RYWID(I)	PHJ(I)	PST(I)	LINC(I)
1	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	9	59.7600	34.5000	22.5000	3.0000	0.3800	0.2100	16.0000
9	9	65.4170	24.7000	25.4000	3.0000	0.4000	0.2270	49.5000
10	7	70.5000	24.5000	30.3000	3.0000	0.4350	0.1830	49.5000
11	7	73.5130	15.6000	34.1000	3.0000	0.4750	0.1500	49.5000
12	7	75.0600	14.7000	33.2000	3.0000	0.4490	0.1750	49.5000
13	7	72.8330	14.6000	31.0000	3.0000	0.4270	0.1950	49.5000
14	7	70.8470	20.5000	32.4000	3.0000	0.4270	0.1800	49.5000
15	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

UPR(N) :	14.8400	32.7700	42.2200	40.0000	90.0000	135.0000	180.0000	
BETA(M) :	0.0	30.0000	45.0000	40.0000	2.2000	2.1000	2.0000	1.9000
OMEGA(L) :	4.0000	3.0000	2.5000	2.3500	2.2000	2.1000	2.0000	1.9000
	1.8000	1.7000	1.6000	1.5500	1.5000	1.4000	1.3000	1.2000
	1.1000	1.0000	0.9000	0.8000	0.7000	0.6000	0.5000	0.4000
	0.3000	0.2000	0.1000					
H13(NW) :	2.0200	4.8000	5.5000	10.2000	16.5000			
OMP(NW) :	0.0	0.0	0.0	0.0	0.0			



100

100

100

SPC 1000 # 4

SPIMS :	0.4274	0.4422	0.4489	0.4345	0.5701	0.5427	0.6272	0.6485	0.6600	0.6842	0.6984	0.7127
	0.7269	0.7417	0.7554	0.7760	0.7942	0.8106	0.8552	0.8908	0.9265	0.9621	0.9878	1.0334
	1.0690	1.1402	1.2114	1.2928	1.3541	1.4254	1.4966	1.5679	1.6392	1.7104	1.7817	1.8530
	1.9242	1.9955	2.0668	2.1380								
SPCTH :	0.0380	0.2576	1.4482	3.4003	6.5918	8.8500	10.7524	11.8114	12.5272	12.8422	13.0157	13.0704
	13.0704	12.8422	12.5272	12.0304	11.4967	11.0989	10.0334	8.9587	7.8317	6.6811	6.1244	5.3643
	4.6242	3.4003	2.7664	2.1380	1.6739	1.3185	1.0475	0.8392	0.6779	0.5517	0.4524	0.3736
	0.2105	0.2597	0.2185	0.1640								

SPECIUM # 5

SPIMS :	0.2322	0.3549	0.3876	0.4153	0.4429	0.4551	0.4872	0.5038	0.5215	0.5315	0.5426	0.5537
	0.5647	0.5758	0.5869	0.6035	0.6201	0.6367	0.6644	0.6921	0.7138	0.7415	0.7751	0.8028
	0.8305	0.8859	0.9412	0.9966	1.0520	1.1073	1.1627	1.2181	1.2734	1.3288	1.3842	1.4395
	1.4949	1.5503	1.6056	1.6610								
SPCTH :	0.1342	1.2637	5.2587	13.0718	23.2573	31.3039	37.9944	41.7372	44.3012	45.3712	45.9921	46.1853
	46.0092	45.5155	44.7548	43.2173	41.3313	39.2189	35.4540	31.6565	28.0273	24.4713	21.4460	18.9550
	16.5837	12.7039	9.7753	7.5735	5.9149	4.6590	3.7014	2.9654	2.3052	1.8416	1.5987	1.3202
	1.0972	0.9178	0.7722	0.6532								

CHANGES (IF ANY) IN STATION FORM PARAMETERS FOLLOW

CVA 66

NSA NROMS NFNC NVL NMOT NSP NP ND NTIHA HASXK NR NSEND NMT MPCM MFC MLEP  
21 27 7 3 0 0 15 9 0 1 0 0 0 0 0 1 0

NSFA NMV NSOMS NS NSPC IN NAPP NFVT  
2 5 0 0 1 0 0 0

CR XLEP REAM DPAET GDAV XCG VCC CM  
0.4023 950.0000 129.3300 37.0000 32.1700 -20.9000 10.4200 9.4000

PVV RXX RZZ XZ1 R40 XPH0 NJI WSIIEFA  
247.5000 59.1600 247.5000 0.0 1.0000000 1.0000000 0.0000128 130664.19

UNIT ORIGIN ZFTAA ALFA  
0 -20.9000 10.0000 0.0393

STATION I	XI(I)	YM(I)	ZM(I)	SIGMA(I)	ZCR(I)	GIRTH(I)	RIFLR(I)	ALPHA(I)
1	495.0000	0.0	0.0	0.0	0.0	4.5000	0.0	0.0
2	445.5000	15.7800	37.0900	1.0692	-17.8600	86.3200	0.0	0.0
3	396.0000	33.0600	37.0800	0.8655	-16.6500	94.2000	0.0	0.0
4	346.5000	51.3400	37.0800	0.8184	-16.3100	107.5000	0.0	0.0
5	297.0000	70.9000	37.0800	0.8091	-16.2600	120.0000	0.0	0.0
6	247.5000	89.2600	37.0800	0.8187	-16.4200	137.4000	0.0	0.0
7	198.0000	104.4600	37.0800	0.8447	-16.4900	150.3200	0.0	0.0
8	148.5000	115.9000	37.0800	0.8854	-16.8700	164.3400	0.0	0.0
9	99.0000	123.3800	37.0800	0.9209	-17.0900	175.6000	0.0	0.0
10	49.5000	127.2600	37.0800	0.9549	-17.3300	185.0400	0.0	0.0
11	0.0	128.9800	37.0800	0.9852	-17.5900	195.2800	0.0	0.0
12	-49.5000	129.2400	37.0800	1.0010	-17.9700	196.0000	0.0	0.0
13	-99.0000	129.3400	37.0600	0.9828	-17.8000	193.8000	0.0	0.0
14	-148.5000	128.7000	37.0800	0.9586	-17.5700	180.9000	0.0	0.0
15	-198.0000	126.3200	37.0900	0.9101	-17.0900	174.5000	0.0	0.0
16	-247.5000	123.7600	37.0800	0.8176	-15.9000	160.8000	0.0	0.0
17	-297.0000	119.6800	37.0800	0.6547	-13.4900	147.4000	0.0	0.0
18	-346.5000	113.5000	37.0800	0.4944	-11.2700	145.0000	0.0	0.0
19	-396.0000	103.6000	21.7500	0.5689	-7.7200	114.3200	0.0	0.0
20	-445.5000	88.3000	14.8000	0.5679	-6.1200	95.0000	0.0	0.0
21	-495.0000	32.8600	3.4000	0.6443	-1.3600	34.8000	0.0	0.0

STATION I	IMBK(I)	BKPAD(I)	BILRAD(I)	BKGP(I)	BKWD(I)	PHI(I)	PSI(I)	LIMB(I)
1	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	9	60.6000	34.5000	23.7000	3.0000	0.4100	0.2360	16.0000
9	9	46.3200	26.7000	27.1600	3.0000	0.4760	0.2250	40.5000
10	7	71.5000	24.5000	31.6000	3.0000	0.4520	0.1920	49.5000
11	7	74.7500	15.6000	35.2000	3.0000	0.4790	0.1650	49.5000
12	7	76.2000	14.7000	34.1600	3.0000	0.4430	0.1560	49.5000
13	7	75.0000	14.6000	32.0000	3.0000	0.4470	0.1880	49.5000
14	7	71.8000	20.5000	30.0500	3.0000	0.4670	0.1870	49.5000
15	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

UOB(N)	:	16.8900	33.7800	42.2300	40.0000	90.0000	135.0000	180.0000	
BETA(M)	:	0.0	30.0000	45.0000	2.3500	2.2000	2.1000	2.0000	1.9000
OMEGA(L)	:	4.0000	3.0000	2.5000	1.5500	1.5000	1.4000	1.3000	1.2000
		1.8000	1.7000	1.6000	0.8000	0.7000	0.6000	0.5000	0.4000
		1.1000	1.0000	0.9000					
		0.3000	0.2000	0.1000					
M13(NW)	:	3.0200	4.9000	6.5000	10.2000	14.9000			
OMP(NW)	:	0.0	0.0	0.0	0.0	0.0			



6650.0	3070.0	2480.0	1001.0
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## SPECTRUM # 4

SPOMS :	0.4276	0.4632	0.4989	0.5345	0.5701	0.5987	0.6272	0.6485	0.6600	0.6642	0.6914	0.7127
	0.7269	0.7412	0.7554	0.7768	0.7982	0.8194	0.8552	0.8908	0.9265	0.9421	0.9978	1.0334
	1.0690	1.1403	1.2116	1.2828	1.3541	1.4254	1.4966	1.5679	1.6389	1.7104	1.7817	1.8530
	1.9242	1.9955	2.0668	2.1380								
SPCTH :	0.0380	0.3576	1.4882	3.6993	6.5818	8.8590	10.7524	11.8116	12.5372	12.6472	13.0147	13.0704
	13.0205	12.8808	12.6656	12.2704	11.6967	11.0989	10.0334	8.9587	7.9317	6.9831	6.1264	5.3643
	4.6932	3.5952	2.7664	2.1433	1.6739	1.3185	1.0475	0.8302	0.6779	0.5517	0.4574	0.3726
	0.3105	0.2597	0.2185	0.1849								

## SPECTRUM # 5

SPOMS :	0.3322	0.3599	0.3876	0.4153	0.4429	0.4651	0.4872	0.5038	0.5205	0.5315	0.5426	0.5527
	0.5647	0.5758	0.5869	0.6035	0.6201	0.6367	0.6644	0.6921	0.7108	0.7275	0.7751	0.8028
	0.8305	0.8859	0.9412	0.9966	1.0520	1.1073	1.1627	1.2181	1.2734	1.3288	1.3842	1.4395
	1.4949	1.5503	1.6056	1.6610								
SPCTH :	0.1342	1.2637	5.2587	13.0718	23.2573	31.3039	37.9944	41.7372	44.3012	45.3792	45.9921	46.1853
	46.0092	45.5155	44.7548	43.2173	41.3313	39.2189	35.4540	31.6565	28.0773	24.6753	21.6480	18.9550
	16.5837	12.7039	9.7753	7.5725	5.9149	4.6590	3.7014	2.9654	2.3052	1.8496	1.5987	1.3205
	1.0973	0.9178	0.7722	0.6532								

CHANGES (IF ANY) IN STATION FORM PARAMETERS FOLLOW

## CVA 68

NSTA NR0MS NFNC NVL NMOT NSP NP MP NTURR HASRK NH NAFND NWT NPCH NFG NFO  
21 27 7 3 0 0 15 9 0 1 0 0 0 0 0 0 1 0

NSEA NHX NSOMS NS NSPC IO NADR NEVT  
2 5 0 0 1 0 0 0

CB XLSP BFAM DRAFT GRAV XCG VCG GM  
0.6210 1040.0000 134.0000 36.8330 32.1740 -13.3000 9.5670 11.0000

RYV RXX RZZ XZI YRHJ NU MSUREA  
260.0000 61.6400 260.0000 0.0 1.9899998 1.9899998 0.0000128 155700.00

UNIT ORIGIN ZETAA ALFA  
0 0.0 0.0393

STATION I	XI(I)	YM(I)	ZM(I)	SIGMA(I)	ZCB(I)	GIRTH(I)	RIFLR(I)	ALPH(I)
1	520.0000	1.0000	36.8330	5.0498	-20.0000	87.0000	0.0	0.0
2	468.0000	18.0000	36.8330	0.9644	-20.0000	87.0000	0.0	0.0
3	416.0000	38.2000	36.8330	0.8216	-18.0000	94.8000	0.0	20.0000
4	364.0000	59.6000	36.8330	0.8000	-16.0000	109.2000	0.0	0.0
5	312.0000	80.0000	36.8330	0.8111	-16.0000	126.0000	0.0	0.0
6	260.0000	98.0000	36.8330	0.8616	-16.0000	144.0000	0.0	0.0
7	208.0000	113.0000	36.8330	0.8967	-16.0000	162.0000	0.0	0.0
8	156.0000	123.0000	36.8330	0.9337	-16.0000	176.8000	0.0	0.0
9	104.0000	129.8000	36.8330	0.9601	-16.0000	188.0000	0.0	0.0
10	52.0000	133.0000	36.8330	0.9774	-16.0000	192.0000	0.0	0.0
11	0.0	134.0000	36.8330	0.9899	-16.0000	202.0000	0.0	0.0
12	-52.0000	134.0000	36.8330	0.9924	-16.0000	202.0000	0.0	0.0
13	-104.0000	134.0000	36.8330	0.9791	-16.0000	197.0000	0.0	0.0
14	-156.0000	133.8000	36.8330	0.9501	-16.0000	188.0000	0.0	0.0
15	-208.0000	132.8000	36.8330	0.8934	-16.0000	178.5000	0.0	0.0
16	-260.0000	130.0000	36.8330	0.7986	-15.0000	167.0000	0.0	0.0
17	-312.0000	124.8000	34.0000	0.7235	-14.0000	157.0000	0.0	0.0
18	-364.0000	116.0000	29.0000	0.6403	-14.0000	149.5000	0.0	0.0
19	-416.0000	102.0000	21.5000	0.5891	-12.0000	112.0000	0.0	0.0
20	-468.0000	82.0000	14.0000	0.5505	-6.0000	87.0000	0.0	0.0
21	-520.0000	55.2000	6.8000	0.5595	-3.0000	58.2000	0.0	0.0

STATION I	IWBK(I)	BKRAD(I)	BILRAD(I)	BKGR(I)	BKWD(I)	PHI(I)	PSI(I)	LIMD(I)
1	2	44.0000	10.0000	0.0	0.0	0.0	0.0	0.0
2	2	44.0000	15.0000	0.0	0.0	0.0	0.0	0.0
3	1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9	7	72.2000	12.0000	31.3000	4.0000	0.4363	0.2094	26.0000
10	7	75.4000	11.0000	32.5000	4.0000	0.4485	0.2094	52.0000
11	7	77.2000	10.2500	34.0000	4.0000	0.4573	0.2094	52.0000
12	7	77.2000	10.2500	34.0000	4.0000	0.4712	0.2269	52.0000
13	7	75.2000	11.0000	32.5000	4.0000	0.4538	0.2269	52.0000
14	7	72.2000	12.0000	31.3000	4.0000	0.4363	0.2443	52.0000
15	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
17	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
18	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19	4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

UCB(N)	:	16.8900	23.7600	42.2500						
BETA(M)	:	0.0	30.0000	45.0000	60.0000	90.0000	135.0000	180.0000		
OMEGA(L)	:	4.0000	3.0000	2.5000	2.2500	2.2000	2.1000	2.0000	1.9000	
		1.8000	1.7000	1.5000	1.5000	1.5000	1.4000	1.3000	1.2000	
		1.1000	1.0000	0.9000	0.8000	0.7000	0.6000	0.5000	0.4000	
		0.3000	0.2000	0.1000						
H13(NW)	:	3.0200	4.9000	6.5000	10.2000	16.9000				
OMP(NW)	:	0.0	0.0	0.0	0.0	0.0				

UCB(IN) :	16.8900	32.7600	42.2500						
BETA(M) :	0.0	30.0000	45.0000	60.0000	90.0000	135.0000	180.0000		
OMEGA(L) :	4.0000	3.0000	2.5000	2.2500	2.2000	2.1000	2.0000	1.9000	
	1.8000	1.7000	1.6000	1.5000	1.5000	1.4000	1.3000	1.2000	
	1.1000	1.0000	0.9000	0.8000	0.7000	0.6000	0.5000	0.4000	
	0.2000	0.2000	0.1000						
H13(INW) :	3.0200	4.9000	6.5000	10.2000	14.8000				
OMP(INW) :	0.0	0.0	0.0	0.0	0.0				







## SPECTRUM # 4

SPOMS : 0.4276 0.4633 0.4989 0.5345 0.5702 0.5987 0.6272 0.6485 0.6700 0.6942 0.7177  
 0.7270 0.7412 0.7555 0.7749 0.7983 0.8196 0.8553 0.8909 0.9345 0.9676 1.0224  
 1.0691 1.1404 1.2116 1.2829 1.3542 1.4254 1.4967 1.5680 1.6393 1.7105 1.7818 1.8531  
 1.9244 1.9956 2.0669 2.1382

SPCTM : 0.0380 0.3576 1.4881 3.6991 6.5914 8.8594 10.7517 11.8109 12.5344 12.8414 13.0664  
 13.0197 12.8800 12.6648 12.2297 11.6960 11.0982 10.0323 8.2582 7.9312 6.9876 5.1240 3.5639  
 4.6929 3.5950 2.7662 2.1432 1.6738 1.3184 1.0474 0.8302 0.6778 0.5517 0.4524 0.3724  
 0.3105 0.2597 0.2185 0.1849

## SPECTRUM # 5

SPOMS : 0.3322 0.3599 0.3876 0.4153 0.4430 0.4651 0.4873 0.5039 0.5205 0.5315 0.5428 0.5517  
 0.5648 0.5759 0.5869 0.6035 0.6201 0.6348 0.6444 0.6921 0.7109 0.7475 0.7752 0.8029  
 0.8306 0.8859 0.9413 0.9947 1.0520 1.1074 1.1628 1.2182 1.2735 1.3289 1.3843 1.4394  
 1.4950 1.5504 1.6057 1.6611

SPCTM : 0.1342 1.2636 5.2584 13.0710 23.2559 31.3070 37.9920 41.7346 44.2984 45.3743 45.9897 46.1824  
 46.0063 45.5126 44.7520 43.2147 41.3987 39.2165 35.4518 31.6545 29.0754 24.6729 21.6467 18.0539  
 16.5827 12.7031 9.7747 7.5730 5.9145 4.6587 3.7011 2.9652 2.3050 1.9495 1.5916 1.3201  
 1.0973 0.9177 0.7721 0.6437

CHANGES (IF ANY) IN STATION FORM PARAMETERS FOLLOW